the other of said two magnetic force line generating portions is fashioned so as to be input said magnetic force lines been output in said plasma generation region by said one of said two magnetic force line generation portions.--

--40. The plasma generation apparatus according to claim 39, wherein

one of said two magnetic force line generating portions comprises a magnet, and is fashioned so that a N pole of said magnet faces said plasma generation region and a straight line connecting a N pole and a S pole of said magnet interests said center axis of said discharge electrode about at a right angle; and

the other of said two magnetic force line generating portions comprises a magnet, and is fashioned so that a S pole of said magnet faces said plasma generation region and a straight line connecting a N pole and a S pole of said magnet intersects said center axis of said discharge electrode about at a right angle.--

--41. A plasma generation apparatus according to claim 37, wherein said two walls are electrode.--

REMARKS

Claims 16 and 22-41 are pending. By this Preliminary Amendment, claims 1-15 and 17-21 are cancelled and claim 16 is amended. Further, claims 22-41 are added. No new matter has been added. The above amendments place the application in better condition for initial examination. Prompt consideration and allowance in due course are earnestly solicited.

Applicants submit that none of the previously cited references Sato Noriyoshi (JP 5-354023), Kinoshita (U.S. Patent No. 5,795,452), Smesny (U.S. Patent No. 5,444,637) nor Inazawa (U.S. Patent No. 5,595,627) disclose or suggest the above-noted features of claims 16, 22 and 37.

With respect to independent claim 16, the previous Office Action mailed May 7, 2001 acknowledges that Sato Noriyoshi does not describe a controller that controls a magnitude of

high frequency electric power applied to the discharge electrode from the high frequency electric power supply, a controller that controls a magnitude of high frequency electric power output from the first and second high frequency electric power supplies and a controller configured so that the ratio of the magnitude of the high frequency electric power output from the first and second high frequency power supplies in a predetermined value.

However, the Office Action suggests that Kinoshita describes these features. Kinoshita describes a dry process system where, according to one embodiment, comprises a first electrode 21 and second electrode 22 electrically connected with each other so that both the electrodes become equipotential. High frequency electric power Ph is synchronously supplied with equiphase to respective electrodes 21, 22 from high frequency power source 6 through blocking capacitor 7. The high frequency power source 6 can be replaced by a two-unit set of high frequency power sources synchronized with equiphase and controlled to have the same power; thereby a similar operation and effect of using one high frequency power source is obtained. In this case electric energy of power supplied to the first and second electrodes from a two-unit set of high frequency power sources through the blocking capacitor can be controlled different from each other. Therefore, distribution of a plasma generated between electrodes 21, 22 can be optimized by suitably adjusting the ratio of electric energy of power supplied to the first electrode to electric energy of power supplied to the first electrode to electric energy of power supplied to the second electrode. See, for example, col. 8, lines 18-36.

However, Kinoshita fails to disclose or suggest a controller that controls a magnitude of high frequency electric power of the first high frequency power applicator and a magnitude of a high frequency electric power of the second high frequency electric power applicator such that the first plasma density and the second plasma density form a uniform plasma density in the plasma generation region, as recited in independent claim 16.

Additionally, neither Smesny nor Inazawa fails to cure the above-noted deficiencies of Sato Noriyoshi and Kinoshita. Smesny merely discloses describing a position adjustment means for adjusting positions of a moveable first electrode inductive wall electrode. Inazawa merely discloses describing an upper first electrically conductive wall electrode 40 has a hollow interior and a large number of gash deficient holes 42 are formed in its entire surface opposite to the wafer W. For reasons as discussed, neither Smesny nor Inazawa cure the above-noted deficiencies of Sato Noriyoshi and Kinoshita.

Prior to discussion independent claim 22, a brief overview with respect to the claim is believed to be helpful. Claim 22 relates to a plasma generation apparatus that obtains high density plasma at least in the center of a plasma generation region where the high-density plasma can be obtained by simple construction and can be obtained without enhancing the size or dimension of a vacuum in the direction of the center axis even if the cross-sectional area of the vacuum vessel becomes larger.

Accordingly, claim 22 cites a plasma generation apparatus, wherein two magnetic force line generating portions are fashioned so as to enclose the plasma generation region and fashioned so as to be spaced at a prescribed distance apart from each other in the direction of a center axis of the discharge electrode.

As disclosed in the application, the magnetic force line can be generated, for example, by two ring-shaped permanent magnets. Accordingly, the high density plasma can be obtained at least in the center of a plasma generation region by simple construction. Further, the high-density plasma can be generated at least in the center of the plasma generation region without enhancing the size or dimension of a vacuum vessel in a direction of the center axis even if the cross-sectional area of the vacuum vessel becomes larger.

Specifically, when magnetic force lines are generated by a plurality of magnetic force line generating portions, using three or more magnetic force line generating portions has to be devised. However, the cross-sectional area of the vacuum vessel tends to become larger

along with an enhanced size of a substrate to be treated. In such case, if the adjacent magnetic force line generating portions are not spaced apart by a larger distance from one another, the magnetic force lines capable of trapping electrons can not be generated in the center of the plasma generation region. However, when using a large number of magnetic force line generating portions, enhance distances between the magnetic force line generating portions may cause the size of the vacuum vessel in the direction of the center axis of the vacuum vessel to be changed into a larger size.

Moreover, when providing three or more odd numbers of magnetic force line generating portions, it is difficult to generate the magnetic force lines capable of trapping electrons in the center of the plasma generation regions.

Accordingly, claim 22 further recites two magnetic force generating portions generating magnetic force lines in the plasma generation region.

Accordingly, the distance between the adjacent magnetic force line generating portions can be long enough to form the magnetic force lines capable of trapping electrons in the center of the plasma generation region without enhancing the size of the vacuum vessel in the direction of center axis even if the cross-sectional area of the vacuum vessel becomes larger. Therefore, the high-density plasma can be obtained without enhancing the size or dimension of a vacuum in the direction of the center axis even if the cross-sectional area of the vacuum vessel becomes larger.

Sato Noriyoshi discloses a magnetic circuit that generates magnetic force lines only in the periphery of the plasma generating region that is capable of trapping electrons. The plasma generated by the device of Noriyoshi is generated in the periphery of the plasma generation region and then diffuses into the center region. See, for example, the constitution of Sato Noriyoshi. However, Noriyoshi fails to disclose or suggest two magnetic force line generating portions fashioned so as to enclose the plasma generating region and fashioned so as to be spaced at a prescribed distance apart from each other in the direction of a center axis

of the discharged electrode the two magnetic force line generating portions generating magnetic force lines in the plasma generation region, as recited in independent claim 22.

Kinoshita fails to cure the above-noted deficiency of Sato Noriyoshi. Kinoshita merely discloses that in order to improve plasma uniformity and generate plasma of high density, it is preferable to make the distance between first electrode 21 and second electrode 22 somewhat small, about 1 cm to 5 cm. See, for example, col. 8, lines 40-43.

With respect to independent claim 37, neither Sato Noriyoshi, Kinoshita, Smesny nor Inazawa disclose or suggest a plasma generation apparatus where a magnetic force line generator is fashioned so at to enclose the plasma generation region that generates magnetic force lines having portions roughly parallel to a center axis of the discharge electrode such that the length of the parallel portions become larger closer the magnetic force lines are to the center axis, the magnetic force lines being capable of trapping electrons at least in a center of the plasma generation region.

As discussed above, Sato Noriyoshi discloses magnetic force lines capable of trapping electrons only in a periphery of the plasma generating region. According to Sato Noriyoshi's apparatus, plasma is generated by the interaction between an electric field and a magnetic field in the periphery of the plasma generation region. This plasma is diffused into the center of the plasma generation region. However, high-density plasma cannot be obtained in the center of the plasma generation region. Therefore, Sato Noriyoshi's apparatus is not intended to form magnetic force lines capable of trapping electrons in the center of the plasma generation region. Stated differently, Sato Noriyoshi's apparatus is not intended to form the magnetic force lines with enough density to be capable of trapping electrons there. Accordingly, Sato Noriyoshi fails to disclose or suggest magnetic force lines being capable of trapping electrons at least in a center of the plasma generation region, as recited in independent claim 37.

For reasons as discussed above, neither Kinoshita, Smesny nor Inazawa cures the above-noted deficiencies of Sato Noriyoshi.

Accordingly, Applicants submit that independent claims 22, 16 and 37 define patentable subject matter. Claims 23-36 and claims 38-41 depend from independent claims 22 and 37, respectively, and therefore also define patentable subject matter. Accordingly, Applicants submit that this application is in condition for allowance. Favorable consideration and prompt allowance of claims 16 and 22-41 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

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JAO:YSC/ale

Date: May 7, 2002

Attachment:
Appendix

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DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461